TARDEC Technical Director (Acting)

Dr. Marilyn Freeman

presentation on

Force Protection

to the

Science & Engineering Technology Conference

TARDEC
U.S. ARMY TANK AUTOMOTIVE RESEARCH, DEVELOPMENT AND ENGINEERING CENTER

Approved for public release;
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Outline

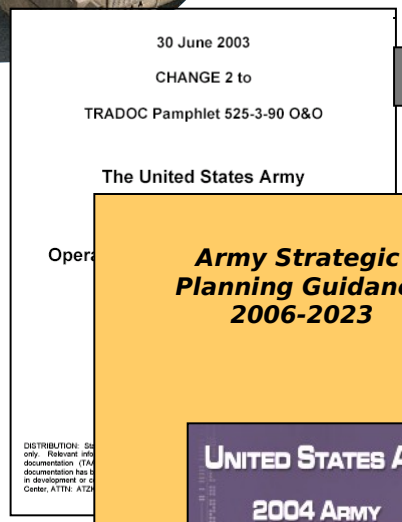
Perspectives:

- ***Science & Technology***
- ***Survivability***

Survivability:

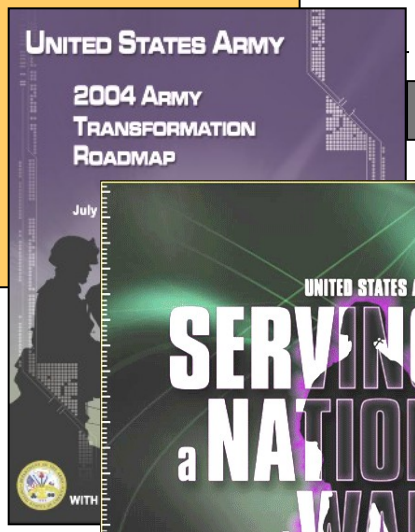
- ***Recent Past***
- ***Present***
- ***Future***

Responding to Army Needs



"…become a more strategically responsive, deployable, agile, versatile, lethal, survivable, and sustainable force, effective in all situations …"

"…provide relevant and ready land power capability to the Combatant Commander as part of the Joint Team"



"…provide dominant land power to the Joint Force now and into the future."

"…change in time of war must deal simultaneously with both current and future needs"

Army S&T Vision: *Pursuing Transformational Capabilities for a Joint and Expeditionary Army*

Current Force

~100 lb. load

70+ tons

< 10 mph

Backpacked

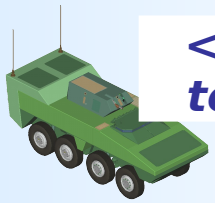
Enabling the Future Force

Science and Technology — develop and mature technology to enable transformational capabilities for the Future Modular Force while seeking opportunities to accelerate technology

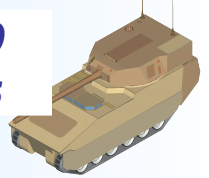
Enhancing the Current Force

< 40 lb. load

Fully networked



< 30 tons



> 40 mph

What is Survivability?

$$\text{Survivability} = \int_m \int_k \int_h \int_f \int_d \int_b f(\text{Armor})\,dx\,dt + f(\text{APS})\,dx\,dt + f(\text{Electronic Warfare})\,dx\,dt + \cdots$$

$$\cdots + \int_l \int_j \int_g \int_e \int_c \int_a f(\text{Signature Mgt})\,dx\,dt + f(\text{Countermine})\,dx\,dt + \cdots$$

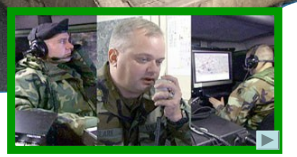
$$\cdots + f(\text{Damage Mitigation})\,dx\,dt + f(\text{Lethality})\,dx\,dt + \cdots$$

$$\cdots + f(\text{Unmanned Platforms})\,dx\,dt + f(\text{TTPs})\,dx + \cdots$$

$$\cdots + f(\text{Platform Design})\,dx + f(\text{Mobility})\,dx\,dt + \cdots$$

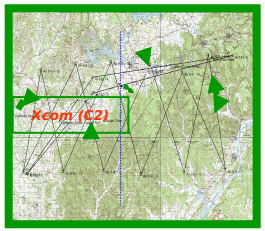
Survivability 'Onion'

Technologies: Recent Past & Present



Multi function OTM Secure Adaptive Integrated Comms

FCS C2



Networked Communications

Mid Range Munition

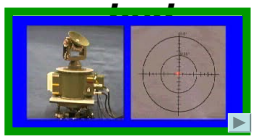
Compact KE Missile

Precision Attack Msl

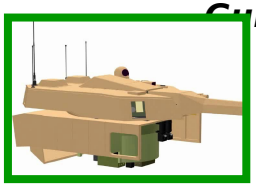
Loiter Attack Msl

CAT VTI Test

LtWt 120mm Gun



SATCOM On The Move



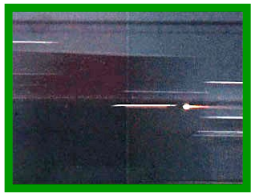
Auto

Close-in Active Protection Sys (APS)

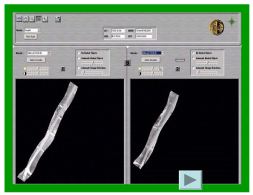
Hummingbi

On The Move APS

Adv Armor



KE APS



Change Detection

UGV

Spinner-

MAV

KPP's

- Network Ready
- Networked Lethality
- Networked Battle Command
- Sustainability & Reliability
- Survivability
- Transportability
- Training

Technologies for the Current & Future Force

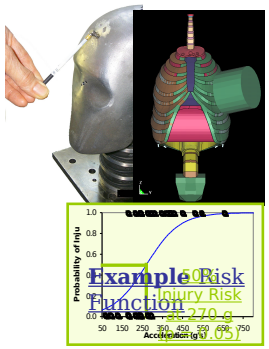
Soldier Protection Technologies
Individual Soldier Ballistic/Blast Protection

- The Warfighter continues to face a significant threat from multiple threats including ballistic and blast
- Personnel armor plays an important role in the survival of our Warfighters
- Soldier Protection Technologies are responding to capability requirements and address the need for:
  - Lightweight protective materials technology that improve the survivability of the individual warfighter against a full spectrum of ballistic and blast threats
  - Tools that provide "leap-ahead" capability to assess individual survivability

Soldier Protection Technologies
Individual Soldier Ballistic/Blast Protection

Key Focus Areas for Research and Development

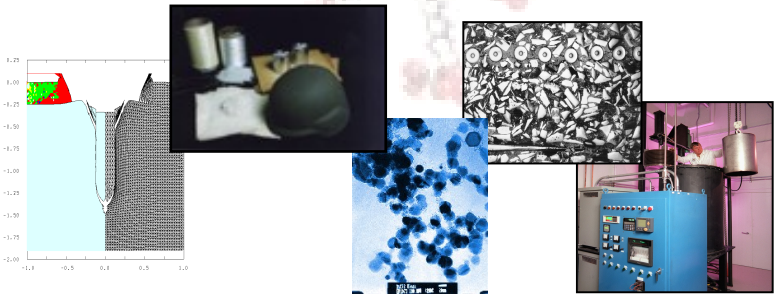
Behind Armor Effects Methodology



Conduct experimental (tissue & test fixture), analytical and numerical assessments of non-penetrating ~~impact on body~~ armor/body

Advanced Technology Development

- New high performance polymers/ fibers/composites
- Nanotechnology
- Advanced ceramics & metals
- Enhanced predictive modeling
- Material systems integration



Casualty Reduction Analysis Model

Develop/update models for armor system performance from threat definition to incapacitation effect

Survivability Technologies: Recent Past & Present

Army Science Board, 2001:
Active Protection Systems (APS) will not be able to achieve their objectives

Significant Strides:

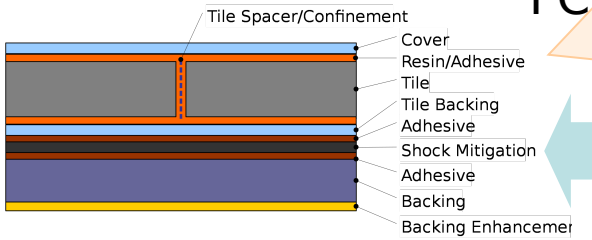
IAAPS: Defeat On-the-move

M Armor: Multiple defeats on single panel

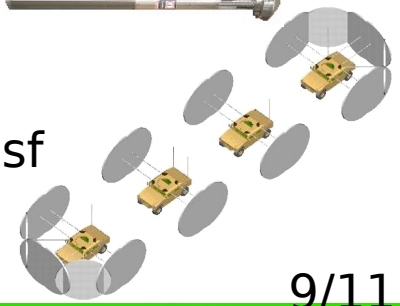
EW: Defeat On-the-move

CIAPS: Defeat On-the-move

FCLAS: Threat defeat demonstrated



allistic Armor: 225 psf down to 64 psf



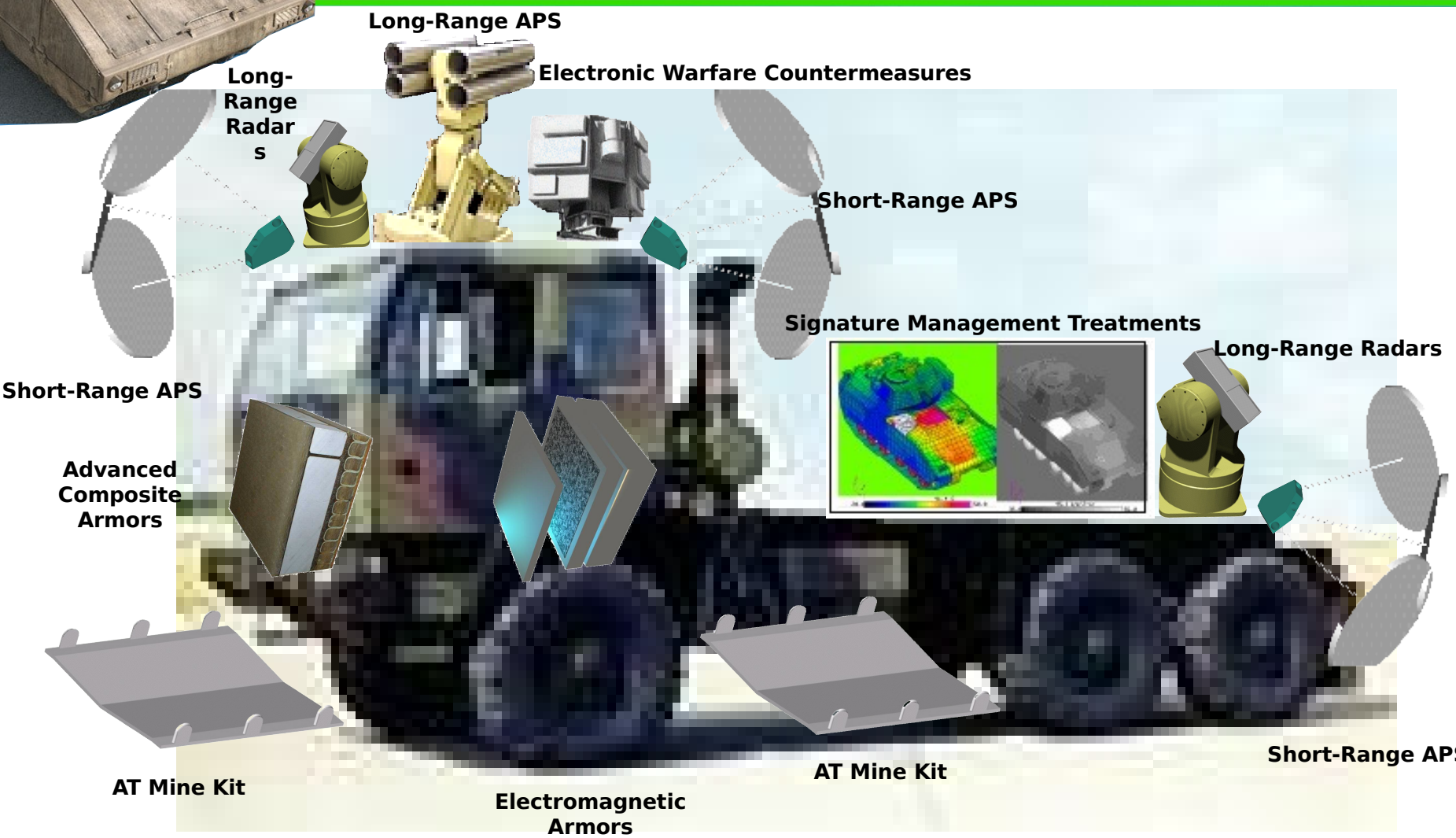
“Come a long way in a short time”

Influences that Drive Our Path Forward

- ***As a result of today's world situation: There is not only technology push, now there is current demand - particularly for survivability***
- ***Current Threats apply not only for Light, Medium & Heavy Combat Vehicles but for Light, Medium & Heavy <u>Tactical</u> Vehicles and unmanned systems***
- ***Emerging Requirements***
- ***Application of Survivability Technologies***
  - ***Address IED protection***
  - ***Address Safe & Arm issues***
  - ***Address Fratricide issues***
  - ***Integration onto Platforms***
  - ***Right mix on Platform***
  - ***Tactics, Techniques & Procedures***

Must Enable Continuous Improvement… i.e. modularity, mission tailorability, commonality…

How Not to Make a Lightweight Vehicle Survivable



… Adding every survivability technology available without trade-off analysis and integration considerations

Path Forward

$$\text{Survivability} = \int_{a}^{m}\int_{b}^{k}\int_{c}^{h}\int_{d}^{f}\int_{e}^{d}\int_{f}^{b} f(\text{Armor})dx + f(\text{APS})dx + f(\text{Electronic Warfare})dx + \cdots + f(\text{Signature mgt})dx + f(\text{Countermine})dx + \cdots + f(\text{Damage Mitigation})dx + f(\text{Lethality})dx + \cdots + f(\text{Unmanned platforms})dx + f(\text{TTPs})dx + \cdots + f(\text{Platform Design})dx + f(\text{Mobility})dx + \cdots$$

Soldier

Future Combat & Tactical Fleets

Integrated Survivability Capabilities

Robotics

Lethality

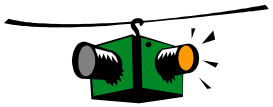
Advanced Survivability Technologies

High Performance Components

Weight & Volume Efficient

Mobility

Current Combat & Tactical Fleets



CAUTION: All along the yellow brick road we should expect signs like: STEEP GRADE; SCHOOL ZONE; LIMITED SPEED ZONE; ROAD NARROWS; STOP; WINDING ROAD; GO; DETOUR; TRAFFIC LIGHTS AHEAD; NO EXIT; NO PASSING; WRONG WAY.

There is a huge challenge before us…our work has only begun… we must find the right path to deliver and implement suites enhancing current and future platform survivability